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AUTHOR Spradlin, Susan D.
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ABSTRACT

Reported is a study to measure one aspect of teacher effectiveness, using teacher classroom behavior and the attitudes developed by students toward their science class, science laboratory, science teacher, and school. Data were obtained from a variety of sources: the Science Classroom Activity Checklist; Student Semantic Differential; Annual Self-Inventory for Science Teachers; Teacher Semantic Differential; Teacher Concern Statement; content tests in biology, earth science, and physical science; and personal information (age, sex, years of teaching experience, teaching area, background preparation, GPA). Forty-eight secondary school science teachers selected for participation in a NSF-funded summer institute (1971) were involved, with 32 of these individuals being considered for statistical analysis. The six questions posed for investigation were translated into six null hypotheses for testing. Statistical analyses revealed that participation in the summer institute program appeared to alter a teacher's classroom behavior patterns toward more student-centered and indirect behaviors. No changes in student attitudes toward their science course or school were identified. Teacher attitudes provided little evidence of alteration, although the participants did express a strong feeling that the institute experience was a valuable one. (PEB)

THE EVALUATION OF A SUMMER INSTITUTE PROGRAM: HAS IT REACHED ITS GOAL?

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by

Susan D. Spradlin
Ph.D. Candidate in Science Education
from
The University of Texas at Austin

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Introduction

The problem of insuring that science teachers are adequately trained involves keeping them up-to-date in content knowledge and often retraining them so that curriculum reforms may be effectively implemented. The most wide-spread means of retraining or training teachers has been the development of special institutes for this purpose.

Privately sponsored institutes appeared in the early 1940s in an effort to ease the then-existing manpower shortage in scientific fields. In 1953 the federal government experimentally funded an institute for college teachers. By 1956 both Summer Institutes and Academic Year Institute Programs for Secondary School Science and Mathematics Teachers were being funded. These programs grew in number and popularity until by 1972, nearly 500 such institutes were being offered nationwide.

Inservice institutes typically offer special courses that are designed to update subject matter and familiarize teachers with the use of new curriculum materials and teaching methods. The stated major institute objective is to effect change in a teacher's classroom behavior as a means of increasing his effectiveness with his students.

Most of the early institute evaluation studies were summative reports dealing with characteristics of the institutes or of the participants. Subjective evaluations have been made regarding

the program's worth, post-participation occupation mobility, the ability of the institute to increase a teacher's professional image, and similar subjects. Hard core data were first collected on the content knowledge gain experienced by participants,this was followed soon by data dealing with participant attitudes and interests. As student achievement is assumed to be enhanced by inservice teacher education, this relationship has also been researched. Most studies of teacher classroom behavior have utilized interaction analysis with small groups of teachers. To date, little has been done to collect hard core data that could aid in evaluating the effect of inservice institutes on teacher classroom behavior as a means of increasing teacher effectiveness.

The Problem

One aspect of teacher effectiveness is measured in this study by teacher classroom behavior and the attitudes developed by students toward their science class, science laboratory, science teacher, and school.

Gage (1963) states that the classroom behavior of a teacher is an integral part of student attitude formation. Thus, any change in the way in which a teacher perceives himself in his role as a teacher or the subject he teaches will reflect itself in his classroom behavior and thereby in the perceptions of his students.

The question stands: Will a teacher's involvement in a summer institute training or retraining program increase his

knowledge and skills, alter his perception of self and subject, and subsequently alter his classroom behavior, thereby increasing his effectiveness with his students?

The Study

To determine the effective, affective, and cognitive factors to be considered, it was decided to examine any change in: a teacher's classroom activities, the attitudes developed by his students toward his course and school, the teacher's attitudes toward the milieu of his work, his perception of himself as a professional person, his concerns about teaching, and his content competencies. Instruments were selected, modified, or developed to collect the desired data.

Instruments Used and Time of Testing

Three instruments were administered twice, in the last half of the spring semester preceeding the institute and again at the same time during the following year of teaching.

1. Science Classroom Activity Checklist (SCAC) This instrument was designed for students to use in describing what goes on in their classroom and was used to measure teacher classroom behavior.

2. Student Semantic Differential (SSD) This contained four protocols: Science Class, Science Laboratory, Science Teacher, and School and was used to measure student attitude.

3. Annual Self-Inventory for Science Teachers (ASIST) It allowed the teacher to rate himself against NSTA's Professional Standards for Science Teachers.

Two instruments were administered three times, at the pre and post-post treatment times designated above as well as at the close of the institute for a post-treatment measure.

4. Teacher Semantic Differential (TSD) This form contained nine protocols: Inservice Institutes, Your Principal's View of Science, Teaching Science, Your Student's View of You, School Board, New Curriculum, The Importance of Science To Your Students, Bussing for Integration Purposes, and The Laboratory Approach to Teaching Science. Protocols 2, 5, and 8 were selected to show the teacher's attitude toward school conditions that are beyond his influence. Numbers 3, 6, and 9 revealed how the teacher views teaching as a job. The two remaining protocols reveal his attitude toward himself as a science teacher.

5. Teacher Concern Statement (TCS) The teacher is simply asked to express the concerns he has regarding teaching.

6. The final instruments, the Biological Science Content Test, the Earth Science Content Test, and the Physical Science Content Test (BSCT, ESCT, and PSCT) were administered to the participants envolled in each content course at the beginning and at the end of the course.

7. Personal information such as age, sex, years of teaching experience, teaching area, background preparation, and GPA for institute courses and outside courses were recorded for each participant.

The Sample

The sample population consisted of 48 secondary science teachers selected for participation in a NSF funded Summer Institute for Secondary Teachers of Science held at The University of Texas at Austin in 1971. In the spring term of the teaching year following the institute, thirty two participants completed the study. Eight teachers had remained in school working toward advanced degrees, four were no longer responsible for science classes, one was on maternity leave, one had retired due to ill health, and two did not respond. Only these thirty two were included in the statistical analysis.

Results

Several null hypotheses were formed to test the fourteen questions engendered by this study. The six hypotheses reported here were all tested by the same statistical treatment. First, Pearson product-moment correlation coefficients were computed using institute participation as one variable and cross-correlations were made with all the remaining variables in the study. This was done to uncover any pre-existing relationships that might contaminate the change scores. In the discussion that follows only significant correlations will be noted. Secondly, group-by-trials analysis of variance was carried out and the F ratios and probabilities were computed.

For all hypotheses rejected the difference between means was significant at the .05 level in a positive direction.

Null Hypothesis 1. There is no difference in the classroom activities of teachers before and after institute participation.

The SCAC yields seven subscale scores as well as a total score. Each participant's talley on this measure represented the mean score of his students.

Significant change scores for five of the seven subscales as well as the total score (Table 1) led to the rejection of null hypothesis 1. There does seem to be a relationship between institute participation and change in teacher classroom behavior.

Null Hypothesis 2. There is no difference in the attitudes of teacher's students toward science class, science laboratory, science teacher, and school before and after institute participation.

The attitude toward each of the four protocols is represented by the evaluative, potency, and activity factors described by Osgood (1956). The mean of the students' responses for each factor is reported as the participant's scores.

There were no significant change scores among the 12 factor scores (Table 2), so null hypothesis 2 is accepted. There seems to be no difference in the attitudes of a teacher's students toward him and his course before and after institute participation.

Null Hypothesis 3. There is no difference in teachers' attitudes toward institute participation, their school situation, teaching as a job, and themselves as science teachers before and after institute participation.

Significant change scores were reported for all comparisons resulting in the rejection of null hypothesis 3. There does seem to be a relationship between institute participation and change in teacher attitudes.

Null Hypothesis 4. There is no difference in the maturity of teacher concerns about teaching before and after institute participation.

The TCS is scored by rating each concern the teacher has listed. The mean and mode of the rated concerns and the concern the teacher marked as most important to him are all recorded. Significant correlations had been found to exist between institute participation and the mean and most important concern for all three trials. As a result, the mode of the teacher concerns was used to test this hypothesis.

There was significant change in the concern mode between pre and post as well as pre and post-post treatment (Table 4) so null hypothesis 4 was rejected. There seems to be a relationship between institute participation and the level of maturity of concerns a teacher has about teaching.

Null Hypothesis 5. There is no difference in teachers' self-evaluation as professionals before and after institute participation.

ASIST is divided into seven subscales that make up the total score. Significant change was found in all but one of the subscales as well as in the total score (Table 5), leading to the

rejection of null hypothesis 5. There seems to be a relationship between institute participation and change in teachers' self-evaluation of themselves as professional persons.

Null Hypothesis 6. There is no difference in the teachers' content mastery before and after institute participation.

As there was significant change found in all three subject area content tests (Table 6) null hypothesis 6 was rejected. There seems to be a relationship between institute participation and a teacher's level of content mastery.

Conclusions

The results of this study would indicate that participation in a Summer Institute program similar to the one studied does work to alter a teacher's classroom behavior patterns toward more student-centered and indirect behaviors. Additional changes were noted in the teacher's perception of himself as a professional person, his level of teaching concerns changed to more student-centered ones, and the teacher's level of content mastery was improved. These could have possibly been contributing factors toward his change in classroom behavior.

Within a one year period there seems to have been no change in student attitudes toward their science course or toward their school. Teacher attitudes altered little except for a strong feeling that the institute experience was valuable after they had returned to the classroom and could presumably utilize some of the knowledge they had acquired. They showed a

strengthened belief in the worth and importance of science for their students. While student attitudes showed no significant changethere were slight indications of a positive trend that could possibly become more positive as the teachers become more secure in their new behaviors and activities.

Importance of the Study

This study could serve as a model for evaluating and comparing teacher retraining programs of all types. It could aid in determining the degree of change in a teacher's classroom behavior that can be predicted following a specific increase in knowledge and change in self perception and evaluation.

References

Gage, N. L. (1963) (Ed) Handbook of Research on Teaching, Rand McNally & Co., Chicago.

SCAC-a modified form of Kochendorfer's Biology Classroom Activity Checklist

SSD and TSD are semantic differential scales originated by- C. E. Osgood, George Suci and Percy Tannenbaum, The Measurement of Meaning, (1965).

ASIST-was developed by the Commission on Professional Standards, NSTA, printed in The Science Teacher, Dec. 1971.

TCS-was developed by Dr. Frances Fuller, Research and Development Center, The University of Texas at Austin.

BSCT-taken in part from the BSCS Testing and Evaluation Student Success with Laboratory Blocks and in part from Testing and Evaluation in the Biological Sciences, CUEBS, Publication #20.

ESCT-was taken from the Achievement Test Questions developed by the ESCP and published in the Teacher's Guide, Investigating the Earth.

PSCT-was designed for use with the Physical Science Resource Guide developed by the Texas Education Agency and written in part by Dr. Earl J. Montague of The University of Texas at Austin.

Table 1

CHANGE IN TEACHER CLASSROOM BEHAVIOR (SCAC)

Range	Pre-Treatment group mean	Post-Post Treatment group mean	F Ratio	Probability
Subscale A. Role of the Teacher				
0-8	4.5921	4.8132		
Subscale B. Class Participation				
0-7	4.2695	4.4960	4.357	.042*
Subscale C. Use of Curriculum Materials				
0-7	3.4661	3.6925	18.427	.003**
Subscale D. TESTS				
0-6	2.9632	3.0714		
Subscale E. Pre-Laboratory				
0-8	4.2812	4.5382	12.120	.001***
Subscale F. Laboratory				
0-9	4.6839	4.9913	5.771	.013**
Subscale G. Post-Laboratory				
0-7	3.7345	4.0428	6.890	.012**
Total Score				
0-53	28.0474	29.6432	13.080	.001***

* sig < .05
** sig < .01 n = 32
*** sig < .001

Table 2

CHANGE IN STUDENT ATTITUDES (SSD)

Protocol Range 0-28	Factor	Pre-Treatment Group Means	Post-Post Treatment Group Means	F Ratio	P
Science Class	Ev.	20.2341	20.6752	.305	.58
	Po.	18.5712	17.7777	3.266	.07
	Act.	17.9005	18.4032	.884	.35
Science Laboratory	Ev.	20.3882	20.5615	.003	.95
	Po.	17.0818	17.3032	.282	.60
	Act.	18.4325	18.7080	.037	.33
Science Teacher	Ev.	22.5978	22.5787	.000	.99
	Po.	18.5745	18.2536	.286	.60
	Act.	19.5789	19.5689	.001	.97
School	Ev.	18.2345	18.6589	.474	.50
	Po.	19.1478	19.5745	.790	.38
	Act.	17.9880	18.1028	.314	.58

No significant differences at the .05 level

Table 3

CHANGE IN TEACHER ATTITUDES

Protocol Range 0-28	Pre Treatment Group Mean	Pre-Post F Ratio	Post Treatment Group Mean	Post-Post-Post F Ratio	Post-Post Treatment Group Mean	Pre-Post-Post F Ratio
Institute						
Ev.	24.6562		23.7187	9.184**	25.8750	5.906**
Po.	20.5937	4.307*	18.8750	3.833*	20.4375	
Act.	22.3750		21.5625	4.695*	22.9375	
School Situation						
Ev.	54.5313	5.626*	51.6562		54.4687	
Po.	53.6875		54.6562		55.4375	
Act.	51.6562		52.5625		53.1250	
Teaching as a Job						
Ev.	73.1250		72.5312		73.4687	
Po.	65.9687		64.3437		65.2812	
Act.	68.4687		67.8437		69.4687	
Self as Teacher						
Ev.	46.3750	7.653**	43.5312	5.008*	46.2812	
Po.	42.0625	2.994*	40.0312	3.877*	42.1562	
Act.	42.8750		41.5000		42.8750	

*sig .05
**sig .01 n=32

Table 4

CHANGE IN LEVEL OF TEACHER CONCERN (TCS)

	Teacher Concern Measure Range					
	Concern for Self ←——————————————————→ Concern for Students					
	1	2	3	4	5	6
Measure	Pre-- Treatment Group Mean	F Ratio	Post- Treatment Group Mean	F Ratio	Post-Post Treatment Group Mean	Pre-- Post-Post F Ratio
Mean	4.2937		4.6911		4.8344	4.440*
Mode	4.4063	4.244*	4.9375		5.0938	6.099**
Most Important Concern	4.3426		4.6874		4.8790	

* sig. .05
** sig. .01

Table 5

CHANGE IN TEACHER SELF EVALUATION (ASIST)

Subscale Range 0-4	Pre-Treatment Group Mean	Post-Post Treatment Group Mean	F Ratio	P
THE PROFESSIONAL SCIENCE TEACHER:				
is well educated in science and the liberal arts.	1.8931	3.6472	26.420	.0001***
posses a functional philosophy of education and the technical skills of teaching.	2.8096	3.0811		
continues to grow in knowledge and skill during his career.	2.1781	2.7144	8.486	.006**
insists on a sound educational environment in which to work	2.[illegible]82	3.0753	12.557	.001***
maintains his professional status.	1.9459	2.3812	5.082	.02*
contributes to the improvement of science teaching.	1.5609	2.1275	10.577	.003**
takes a vital interest in the quality of future science teachers.	1.2572	2.1706	17.786	.0004***
Total Mean Score	2.0250	2.6116	16.978	.0005***

* sig $<.05$
** sig $<.01$ n = 32
*** sig $<.001$

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Table 6

Change in Science Content Knowledge

Teacher Number	Earth Science		Biological Science		Physical Science	
	Pre	Post	Pre	Post	Pre	Post
020772111			34	54	50	76
030262011			24	48		
040 11102	50	74	32	50		
05[illegible]607					18	40
06[illegible]1303	72	56			50	70
07[illegible]1000	70	48				
08[illegible]12305			34	54	60	72
09[illegible]072307			22	40	28	56
10[illegible]061203	50	62	20	58		
11[illegible]011609					16	42
12[illegible]060					88	96
13[illegible]2102			40	56	72	86
14[illegible]32607	76	[illegible]	2	[illegible]	92	84
15[illegible]3	72	[illegible]	[illegible]	76		
16[illegible]					60	90
17[illegible]6101	36	70			36	71
18[illegible]1305	64	[illegible]			36	56
19[illegible]2406	36	72	18	36		
20[illegible]1011	76	[illegible]			66	76
21[illegible]2001	36	[illegible]	[illegible]	58		
22[illegible]1018	66	72			40	66
23[illegible]1204	28	52	22	48		
24[illegible]2015	34	68				
25[illegible]6303	72	92				
26[illegible]1016	78	82	52	68		
27[illegible]2407			10	16	16	38
28[illegible]2208	34	42	[illegible]	38		
29[illegible]1319			28	38	54	52
30[illegible]1101	56	84			80	88
$\bar{X}$ Mean	55.33	73.66	26.75	48.62	49.76	68.17
St. Dev.	17.56	13.23	14.01	14.24	22.92	17.67
$\bar{X}_1 - \bar{X}_2$	18.33		21.87		18.41	
t statistic	3.5070		4.23980		2.54396	
sig.	$< .01$		$< .001$		$< .02$	
	n=18		n = 16		n=17	